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OCTOBER TERM, 1998

UNITED STATES DEPARTMENT OF COMMERCE, *et al.*,
Appellants,

v.

UNITED STATES HOUSE OF REPRESENTATIVES, *et al.*,
Appellees.

On Appeal from the United States District Court
for the District of Columbia

**BRIEF OF AMICUS CURIAE
THE FOUNDATION TO PRESERVE THE
INTEGRITY OF THE CENSUS
IN SUPPORT OF APPELLEES**

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INTEREST OF AMICUS CURIAE

The Foundation to Preserve the Integrity of the Census (the "Foundation") is an independent, non-profit, non-partisan organization chartered to educate the public regarding the decennial census.¹ Since 1790, the census has determined essential information about the people of the United States that guides Congress in developing legis-

¹ The Foundation is not related in any way to any party in this case, and no party or its counsel has authored any part of the Foundation's brief. No person or entity other than the Foundation and its counsel has made a monetary contribution to the preparation or submission of this brief.

lative programs and guides the Executive Branch in carrying out those programs. The census serves many purposes beyond its constitutional purpose of apportioning Congressional representatives among the fifty states. In its 1997 *Report to Congress: The Plan for Census 2000*, the Census Bureau ("Bureau") announced its plan to use statistical sampling in an attempt to make the year 2000 census more accurate in carrying out its bedrock constitutional purpose of apportionment. Joint Appendix ("J.A.") 34-147. According to that *Report*, statistical sampling is the only means of achieving an accurate count of the population of the United States and has been strongly endorsed by knowledgeable statisticians. The Foundation believes, to the contrary, that the use of statistical sampling in the census cannot increase its accuracy in determining exactly where the people of the United States live and how many of them there are. Accordingly, the sampling plan cannot increase the accuracy of the census in accomplishing its core constitutional purpose of apportionment. Indeed, the statistical sampling proposed by the Bureau will almost certainly make the census less accurate and undermine its legitimacy.

The Foundation submits this brief to inform the Court about factual and statistical issues relevant to the legal issues in this case.

Counsel for the parties have consented to the filing of this amicus brief. Their letters of consent have been filed with the Clerk.

INTRODUCTION AND SUMMARY OF ARGUMENT

The Bureau proposes to change the traditional census methodology of "physical enumeration"² by using statistical sampling at two stages for two different purposes. *First*, the Bureau proposes to use statistical sampling to speed up—and reduce the cost of—the traditional follow-

² This is the term used in the Bureau's *Report to Congress*. *E.g.*, J.A. 121.

up applied to households that fail to return a census form (called "Non-Response Follow-Up" or "NRFU"). *Second*, the Bureau proposes to determine the degree to which particular groups in each state have been "missed" and to adjust correspondingly the numbers from the traditional "physical enumeration." This second use of statistical sampling is called "Integrated Coverage Measurement" or "ICM." It is based on the "Post Enumeration Survey" or "PES" that was carried out in connection with the 1990 census.³ This second use of statistical sampling is by far the "most critical" one, as the Bureau acknowledges. J.A. 92. The use of statistical sampling to correct for individuals who have been missed in the census, and thus to eliminate the undercount in previous censuses, is supposed to make the 2000 census 99.9% accurate—much more accurate than any previous census.⁴ The Bureau claims statistical sampling will greatly reduce differences in the rate at which members of different demographic groups in different locations are undercounted. *E.g.*, J.A. 117, 358-61, 372, 411-13.

The Bureau intends to "correct" the census count in the year 2000 to include individuals who have been missed. It will attempt to do that based on the results of the ICM "mini-census" of 25,000 census blocks randomly selected from the 7 million census blocks nationwide. J.A. 92-98, 364-68.⁵ After the initial census count,

³ The 1990 PES was judged too inaccurate and unreliable to use to adjust the actual census count.

⁴ The Bureau does not claim that statistical sampling as part of the NRFU will increase the accuracy of the census. *See, e.g.*, J.A. at 158-59 (claiming only that "[i]t will ensure that we can complete our personal visits with no loss of accuracy but with substantial savings of time and money") (emphasis added). Indeed, statistical sampling will make it less accurate. *See* n.12, *infra*.

⁵ On average, a census block contains 30 housing units. J.A. 94. For each state, the Bureau plans to define non-overlapping groups of census blocks (called "strata") that are homogeneous with regard to characteristics of their population that the Bureau thinks affect the likelihood that they will be counted in the census—for

the Bureau will attempt to contact every household in the randomly selected blocks, creating an "independent roster of Census Day residents." J.A. 95. That is, within these blocks, the Bureau will conduct a second census, on a smaller scale but more intensively.

The individuals surveyed in these blocks will be grouped into homogeneous groups (called "post-strata") that have what the Bureau considers to be a similar likelihood of being counted in the traditional census. These "post-strata" will be defined by known characteristics associated with the census undercount, such as age, race, gender and housing status (renter versus home-owner)—for example "Black male renters aged 20-29 living in New York State" or "Hispanic male renters aged 30-39 living in California."

Individuals included in the "independent roster" from this mini-census but not in the traditional census will be judged to have been missed. J.A. 95-96. Comparing the results of the traditional census with the results of the mini-census of these randomly selected blocks, the Bureau will determine an "estimation factor" for each post-stratum in each state reflecting the likelihood that individuals in each post-stratum were missed. These estimation factors will be used to "correct" the initial counts for all demographic groups with the same characteristics (such as "Hispanic male renters aged 30-39") in every block throughout the state. The adjusted state counts will be totaled to yield an adjusted count for the nation. J.A. 97-98.

In fact, the Bureau's ICM sampling plan is unlikely to enhance the accuracy of the census. The estimated undercount in the census is very small by statistical standards—approximately 1.8% of the population in the Bureau's

example, "[a]ll blocks in large central cities with a 1990 Census population that was 30% or more African American renters with 10% or more Hispanic renters." J.A. 94. *Accord* U.S. Bureau of the Census, "ICM Stratification and Poststratification: Research Plans for Census 2000," April 24, 1998, at 1. The blocks for the mini-census are randomly selected from these strata.

best estimate. J.A. 40. Even a perfectly designed and executed sampling plan would have difficulty reducing such a low error rate in such a large population. Both sampling and nonsampling error are inevitable in any statistical sampling. Even very small errors are greatly magnified when applied to the estimated 98.2% of the population that was correctly counted. This "magnification" problem is aggravated in the context of the census because a large percentage of those "missed" in the traditional census probably did not wish to be counted. They are therefore likely to evade the census-takers in the ICM mini-census too. As a result, data on the population actually undercounted are especially likely to be inaccurate. Using those inaccurate data to "correct" the undercount is far more likely to distort the census count than to make it more accurate.

The Bureau's sampling plan can be expected to distort the census count, rather than enhance its accuracy, because of sampling and nonsampling errors that have been recognized in the past and cannot be eliminated. There were intractable problems in 1990 matching the returns from the traditional census with the returns subsequently obtained from the same households in the 1990 mini-census of randomly selected areas. Mini-census returns that cannot be matched with the traditional census returns are assumed to identify households that were missed in the traditional census. Even a small number of matching errors—identifying households as "missed" that were actually counted—can have a very large impact on the final census count because the results of the small mini-census are used to "adjust" the nationwide census count.

The adjustment process also distorts the national count because it assumes that all members of a defined group (such as "Hispanic male renters aged 30-39") are uniformly likely to have been undercounted everywhere within a state. The adjustment process, accordingly, will increase the count for that group throughout a state by the same

percentage. The likelihood that some mini-census returns will be fabricated, especially in inner-city areas, makes this problem worse. Fabricated returns, for example, may create "Hispanic male renters aged 30-39," to use the same example, who will appear to have been uncounted because they do not exist. These fabricated returns will thus increase the weight given to all the "Hispanic male renters aged 30-39" who were counted in every area of a state.

These and other similar problems with the Bureau's plan have led many statistical experts who have looked closely at the plan's details to question its validity. Contrary to the Bureau's claim, its plan has not been endorsed by a consensus of informed scientific opinion. The endorsements are vaguely general or contingent upon assumed conditions the plan is unlikely to meet. The claimed "consensus" is illusory.

In fact, use of statistical sampling to correct for a very small estimated undercount nationwide can be expected to make the 2000 census much less accurate, introducing substantial distortions based on both sampling and non-sampling error.

ARGUMENT

I. THE UNDERCOUNT IN THE TRADITIONAL CENSUS IS VERY SMALL, NEARLY IRREDUCIBLE, AND PROBABLY BEYOND THE CAPABILITY OF STATISTICAL SAMPLING TO CORRECT

The Bureau estimates that the 1990 census missed 1.8% of the United States' population, or 4.7 million people—despite being better designed and more expensive than the 1980 census. J.A. 40.⁶ The Bureau charac-

⁶ The exact size of the undercount in the census can only be estimated. Until 1990, undercount was estimated by comparing the census count with the results of "demographic analysis," which uses data on births, deaths, immigration, and emigration and earlier census data to estimate the number of persons living in the United

terizes this estimated undercount as "a large step backwards in terms of accuracy," compared to the 1980 census, which (the Bureau estimates) missed 1.2% of the population. *Id.* The Bureau predicts that, without correction by statistical sampling, the undercount in the 2000 census will increase further to 1.9% of the population. J.A. 121. Worse, the Bureau predicts, the differential undercount of certain segments of the population in certain areas will continue to increase. *E.g.* J.A. 51-52. It is this undercount that the Bureau's sampling plan is designed to address. Indeed, the entire purpose of the plan is to greatly reduce or eliminate the estimated undercount.

To understand why the Bureau's plan to use statistical sampling to reduce this estimated undercount is inherently flawed and cannot be expected to work, it is essential to recognize three interrelated key facts. *First*, the estimated undercount is very small; *second*, the estimated undercount is probably largely inherent in the nature of the population that is missed in the census; and *third*, the Bureau proposes to reduce this very small undercount in the census through a second, much smaller census that is likely to miss the same people as the traditional census. The data from the smaller census will thus be poorest where they are most important, making the most important adjustments to the traditional census count the least accurate. These three factors make it virtually impossible for any statistical sampling, no matter how well designed and executed, to make the census more accurate.

A. The Estimated Undercount Is Very Small By Statistical Standards

A nationwide undercount of 1% to 2% is very small, given the size of the population and the difficulties in-

States. J.A. 48 (Report to Congress), 368 (Fienberg Declaration), 410 (Estrada Declaration). In 1990, the Bureau also used statistical sampling, but this statistical sampling found less than half the undercount estimated by demographic analysis. J.A. 369 (Fienberg Declaration).

herent in the enumeration process. A margin of error of 1% to 2% is extraordinarily low by statistical standards—and is very difficult to achieve, given the sampling and nonsampling errors inherent in the process. To *estimate* the size of the population with a high level of confidence to within 1% to 2% of its actual number by statistical sampling would be a daunting and very likely impossible task. To use statistical sampling to *adjust* the census count requires a substantially lower margin of error in the statistical sampling than in the unadjusted census count. Any error in the adjustment factor intended to correct for missing a relatively small part of the population will be magnified many times over as it is applied to the 98% to 99% of the population that was correctly counted.⁷ To improve on the estimated undercount in the 1990 census through the use of statistical sampling would thus be difficult, if not impossible, under ideal circumstances. The decennial census presents circumstances far from ideal.

B. The Estimated Undercount Probably Consists Largely of Groups Much More Difficult to Count Than the Rest of the Population

The Bureau itself attributed the estimated increase in the 1990 census's undercount to factors that will continue to pose problems for statistical sampling as much as for attempts at a direct enumeration. Those factors include:

- fewer people at home when enumerators visited;
- more people at home but unwilling to take the time to fill out a census form;

⁷ See Kenneth Darga, "Straining Out Gnats and Swallowing Camels: The Perils of Adjusting for Census Undercount" (hereinafter "Darga, 'Gnats and Camels'") and "Quantifying Measurement Error and Bias in the 1990 Undercount Estimates" (hereinafter "Darga, 'Error and Bias'"), Office of the State Demographer, Michigan Department of Management and Budget (April 29, 1998) (prepared testimony presented to the House of Representatives Subcommittee on the Census in May 1998).

- more people living in gated communities where security guards do not cooperate with enumerators;
- more people "alienated from society in general and more mistrustful of government in particular [and] more concerned about privacy."

J.A. 51.

Worse, many segments of the population that census-takers are especially likely to miss are growing more rapidly than the rest of the population. These segments include people living in illegal housing units; people believing that census information will not be kept confidential; and people relying on concealment to protect their resources. J.A. 52. As one of the experts for the Bureau acknowledges, the Bureau has difficulty reaching people living in illegally subdivided homes because it is difficult to obtain addresses for them. J.A. 411. If the Bureau had an address for residents of illegal housing, those residents could be expected to evade the census-taker for fear of losing their housing. Similarly, the Bureau's expert acknowledges, "probation violators, debtors hiding from creditors, and battered spouses hiding from their partners" will "seek not to be counted," even if the Bureau has their addresses. J.A. 412. So will those who "fear discovery by federal authorities, *e.g.*, undocumented immigrants." *Id.* The number of illegal immigrants alone now exceeds the total estimated undercount in the 1990 census.⁸ Parents failing to make court-ordered child-support payments could similarly be expected to evade the census-taker.

⁸ The Immigration and Naturalization Service estimates that there were 5 million illegal immigrants in the United States in October 1996 (plus or minus 400,000). 74 INTERPRETER RELEASES 298 (February 24, 1997). At the same time, the INS adjusted upwards its estimate of the number of illegal immigrants who had been in the United States in 1992 from 3.4 million to 3.9 million. *Id.* For numbers of other groups that can be expected to avoid the census-taker, *see* Darga, "Gnats and Camels," at 1.

In 1995, there were over 19 million cases in the Child Support Enforcement Program.⁹

C. The Population "Missed" in the Traditional Census Is Likely to Be Missed Again in the Attempt to Adjust for the Undercount

The Bureau plans to determine what groups the traditional census missed—and in what proportions—through a second, smaller census of a randomly selected group of 25,000 census blocks out of the 7 million census blocks nationwide. Only the areas to be canvassed in this ICM mini-census constitute a random sample. Within the sample blocks, the Bureau will conduct a second census and then compare its results with the results of the larger census. It will then attempt to adjust the results of the larger census (already 98% to 99% accurate) based on the differences it finds between the two results.

To the extent that individuals "missed" in the physical-enumeration phase of the census deliberately evaded the census-taker, they can be expected to evade the Bureau's subsequent mini-census too. There is no reason to think that these difficult-to-count individuals who are suspicious of government will be more willing to sit down with a census-taker equipped with a laptop computer¹⁰ than they were to mail in a traditional census form or to sit down with a census-taker equipped with a pencil and paper form as part of the traditional census's follow-up for households that did not mail in a form. Moreover, to the extent that language is a barrier to an accurate count—as the Bureau concedes it often is, J.A. 51—the Bureau employee with his or her laptop computer can be

⁹ BUREAU OF THE CENSUS, UNITED STATES DEP'T OF COMMERCE, STATISTICAL ABSTRACT OF THE UNITED STATES 1997, Table 611 at 390.

¹⁰ Under the Bureau's plan, "enumerators will administer the ICM questionnaire and enter data via laptop computers." J.A. 95.

expected to have *more* difficulty collecting information than the traditional census with its mail-in forms. These forms will be available in many languages besides English in the 2000 census, and the non-English speaker can obtain assistance from friends or neighbors in translating questions and answers. Filling out paper forms is also more anonymous than a face-to-face interview. Anyone unwilling to complete a paper census form or talk to a census-taker following up because he or she does not trust the government or wants to escape its notice is unlikely to agree to an interview with a census-taker armed with a laptop computer.

One of the Bureau's experts concedes that "undercount is a consistent and unavoidable feature of census-taking." J.A. 410. The "feature" of the traditional census that the Bureau will attempt to correct by statistical sampling can be expected to reappear in the ICM mini-census that is supposed to correct the 1% to 2% undercount.¹¹

II. THE CENSUS BUREAU'S PLAN CAN BE EXPECTED TO DISTORT RATHER THAN CORRECT THE POPULATION COUNT IN THE TRADITIONAL CENSUS—ESPECIALLY FOR PURPOSES OF APPORTIONMENT

The problems inherent in attempting to correct a 1%-2% undercount would be reason enough to question the Bureau's sampling plan for the 2000 census. However, the Bureau's plan is also infected with specific deficiencies and likely errors that will probably distort the population count.

¹¹ The sample that will be used to adjust the 2000 census results will be five times as large as the corresponding sample in 1990—25,000 blocks (about 750,000 housing units) as opposed to 5,000 blocks divided into demographically similar groups or strata. J.A. 93-94, 371. The strata in 1990 crossed state lines; the strata in 2000 will not. J.A. 94, 372-73. Limiting strata to state boundaries will largely eliminate the statistical benefits of a larger overall sample in 2000.

Many different kinds of error affect the accuracy of any statistical survey. These kinds of error are broadly divided into two categories: (1) sampling error and (2) nonsampling error. Sampling error occurs because a random sample does not exactly reflect the population from which it is drawn. Nonsampling error (or bias) includes everything else that distorts the result besides the random luck of the draw. See J.A. 115-16. Only nonsampling error can occur in the traditional census (because a census is not a random sample). Both sampling and nonsampling error affect the reliability of the Bureau's planned "correction" of the traditional census count. As the Bureau acknowledges, measuring and reducing nonsampling error is more complex than measuring and reducing sampling error, and the nonsampling error is more serious. *Id.*

A combination of sampling and nonsampling error makes it likely that the Bureau's attempt to adjust the census count will not only fail to improve the traditional census count but will actually distort the count and produce less accurate data because very small errors in the "corrective" mini-census will have an exaggerated impact on the 98% to 99% correct count from the traditional census.

A. Sampling Error

Sampling error will occur because (1) the strata are not perfectly homogeneous, (2) the blocks selected from them do not perfectly reflect the composition of the strata, and (3) individuals assigned to each post-stratum do not perfectly reflect the population of the post-stratum.¹²

¹² The Bureau's NRFU plan will also introduce sampling error into the census by truncating the conventional follow-up for households that do not send back a census form. The Bureau will use sampling to determine which units to contact to bring the total percentage of units contacted up to 90%. (For example, if only 60% of the housing units in a tract return a census form, three out of four of the remaining housing units will be sampled to achieve the 90% goal.) After sampling is complete, the Bureau will use

The Bureau's methodology calls for dividing the population into post-strata defined by demographic criteria. Differences between the census and the mini-census are used to calculate net undercount rates for each post-stratum. These rates are then used to adjust all post-strata in every block through extrapolation; that is, the rates calculated from the 25,000 census blocks in the mini-census will be applied to all 7 million blocks across the country.

In applying rates from the randomly selected census blocks within a state to all census blocks within a state, the Bureau relies on the "homogeneity assumption." That is, the Bureau assumes that undercount rates for each post-stratum are constant across an entire state, or homogeneous. The result is that

the number of Hispanic male renters age 30-39 in every single block in California—from the barrios of east Los Angeles to the affluent suburbs of Marin County and beyond—would be scaled up by the same adjustment factor.

Lawrence D. Brown, et al., "Statistical Controversies in Census 2000," Technical Report, Dep't of Statistics, U.C. Berkeley (October 1998) (hereinafter "Brown 1998") at 9.

information from the 90% of units actually contacted to estimate characteristics such as race and size of household for the remaining 10%. See J.A. 88-92; Preston Jay Waite & Howard Hogan, Bureau of the Census, U.S. Dep't of Commerce, "Statistical Methodologies for Census 2000: Decisions, Issues and Preliminary Results," presented at the Joint Statistical Meetings, Dallas, Texas, Aug. 1998, at 2-5. The Bureau's NRFU sampling plan has never been tested on a national basis, and the accuracy of the imputation process is unknown. See Congressional testimony of Robert A. Koyak, Sep. 17, 1998. It seems likely that the NRFU will be less accurate than the traditional attempt at 100% enumeration. The Bureau proposes to use statistical sampling at this stage of the 2000 census in order to save time and money that can then be used in the ICM stage of the Bureau's plans.

However, if the rates for a demographic group *differ* in various geographic areas within a state, applying the same adjustment factor to members of this demographic group in every census block will decrease rather than increase census accuracy. For example, if the net undercount rate for Hispanic male renters age 30-39 calculated from the randomly selected California blocks in the mini-census is 4%, but the undercount rates for the blocks in the state that were not randomly selected are in the 2-3% range, adjustment will erroneously increase the census count.

Research on the adjustment proposed in 1990 indicates considerable heterogeneity in undercount rates. See David Freedman & Kenneth Wachter, *Heterogeneity and Census Adjustment for the Post-Censal Base*, 9 STATISTICAL SCIENCE 476-485 (1994). This finding is not surprising. By assuming constant net undercount rates for demographic post-strata across vastly different geographic areas, the Bureau implicitly assumes that all the factors affecting the undercount for each post-stratum—such as poverty, immigration status, suspicion of government—all have the exact same effect on whether or not an individual is enumerated by the census.

In order to address concerns about heterogeneity, the Bureau has confined strata and post-strata adjustment within state boundaries. (In 1990, strata and post-strata adjustments applied across state lines.) Unfortunately, this change increases the number of strata and post-strata. That, in turn, increases sampling error and largely offsets the decrease in sampling error that would otherwise follow from the 5-fold increase in the number of blocks sampled. Partly as a result, the Bureau has also decided to drop one type of strata classification: area of residence (urban, suburban, or rural). Thus heterogeneity may be more problematic in 2000. See Brown 1998 at 9.

B. Nonsampling Error

Nonsampling error in processing and interrelating the data from the traditional census and from the ICM mini-census is much more serious than sampling error. In 1992, a high-level committee within the Census Bureau—the CAPE Committee¹³—estimated that about half the statistically estimated undercount in the 1990 census was “actually measured bias [another term for nonsampling error] and not measured undercount.” CAPE Report at 15. Nonsampling error can take many different forms. We focus here on data errors (including fabricated interviews), computer errors, correlation bias, and matching errors.

1. Data Errors

“Bad” data constitute nonsampling error. “Bad” data include incorrectly entered addresses, illegible forms, duplicate forms not recognized as such, incomplete or incorrect information provided by census respondents, and fabricated interviews either during the non-response follow-up of the census or during the mini-census survey.

¹³ “CAPE” stands for “Committee on Adjustment of Postcensal Estimates.” The CAPE Committee was formed in 1991, after the Secretary of Commerce decided against adjusting the 1990 census count. It consisted of “a senior level group of the Bureau of the Census statisticians and demographers,” meeting regularly with the Director of the Census. Its mission was to direct additional research to determine whether the statistical sampling methodology that had been considered inadequate to adjust the 1990 census could be refined enough to improve “intercensal population estimates,” for which high rates of error at the level of census blocks and census tracts would not be an issue. Intercensal population estimates “are not prepared for census tracts and blocks, or used for redistricting, as are census data.” Statement of the Director of the Census, December 29, 1992, 58 Fed. Reg. 69, 70 (1993). The CAPE Committee’s report, “Assessment of Accuracy of Adjusted versus Unadjusted 1990 Census Base for Use in Intercensal Estimates,” August 7, 1992, is cited herein as “CAPE Report.”

The Bureau has wrestled with all of these. After the 1990 census the Bureau did an extensive series of evaluation studies on the 1990 mini-census, which resulted in over a dozen different reports totaling almost one thousand pages. See CAPE Report at 9. Based largely on the Bureau's own studies, some statisticians have independently concluded that at least 80% of the individuals who would have been added through statistical adjustment to the 1990 census really reflect bad data. See L. Breiman, *The 1991 Census Adjustment: Undercount or Bad Data?* 9 STATISTICAL SCIENCE 458, 472 (1994) (hereinafter "Breiman 1994").

a. *Incorrectly Recorded Addresses*

The Bureau assigns housing units to census blocks by address. (This is called geocoding.) Mistakenly recording an address as "1075 Main Street" rather than "1076 Main Street" would put the household on the other side of the street and in the wrong block. Office of Inspector General, U.S. Dep't of Commerce, "2000 Decennial Census: Key Milestones and Associated Risks" (December 1997) at 10 (hereinafter "1997 Inspector General's Report"). If either the initial census or the mini-census incorrectly assigns a housing unit to the wrong block but the other does not, the individuals in that unit will appear to have been missed by the census. Recognizing this problem, the Bureau in 1990 regularly searched one or two rings of blocks around each mini-census sample block in order to correct for geocoding errors. Over 4 million individuals would have been added to the national census count without this wider search. It is unclear how many additional geocoding errors would have been discovered if the search areas had been even larger.¹⁴ Given the

¹⁴ Entering "1300 Main Street" incorrectly as "1800 Main Street" would sort the household 5 blocks down the street. See 1997 Inspector General's Report at 10.

large number of errors caught by searching in the one- and two-block rings, it is likely that there may have been substantial geocoding errors outside the search area that were *not* caught and inflated the undercount rate. See Breiman 1994 at 467-468.

For the 2000 census, the Bureau has decided to limit its search to the blocks in the sample and not to search the surrounding blocks as it did in 1990. 1997 Inspector General's Report at 10. Given the extent to which matches were found in surrounding blocks in 1990, substantial geocoding errors seem likely in 2000. *Id.*

b. *Fabricated Interviews*

Fabricated interviews—or "curbstoning"—are a serious problem for any survey. It is an especially serious problem when it occurs in a mini-census intended to correct the census count. Fabricated households in the mini-census will appear to have been missed. If not recognized as spurious, they will be included in a correction factor applied to an entire post-stratum. Instead of the single wrong count in a census, an undetected fabrication in the mini-census will effectively be counted many times over. Studies show that temporary workers are more likely to fabricate than permanent interviewers. Unfortunately, the Bureau is forced to rely on temporary workers for much of its interviewing, both in the census and the mini-census. Studies also show that interviews are more likely to be fabricated in difficult areas. See L. Stokes & P. Jones, *Evaluation of the Interviewer Quality Control Procedure for the Post-Enumeration Survey*, PROCEEDINGS OF THE SURVEY RESEARCH METHODS SECTION, AMERICAN STATISTICAL ASSOCIATION, at 696-698 (1989). These studies imply that fabricated interviews will not be distributed randomly but instead will occur disproportionately in minority and urban areas.

The fabrication rate from the 1990 mini-census is impossible to know exactly. See Kristen K. West, "1990

Post-Enumeration Survey Evaluation Project P6: Fabrication in the P-Sample: Interviewer Effect" (July 10, 1991) (hereinafter "West 1991");¹⁵ Breiman 1994 at 467. The Bureau itself estimated that between 0.5% and 1.5% of its interviews were fabricated. West 1991 at 1; P. Biemer & S. Stokes, *The Optimal Design of Quality Control Samples to Detect Interviewer Cheating*, 5 JOURNAL OF OFFICIAL STATISTICS 23-29 (1990). Others have estimated a fabrication rate between 0.03% and 8.79%. Breiman 1994 at 467; Darga, "Error and Bias," at 5-7. An undetected fabrication rate of 0.03% (the low end of the estimated range) would have added 50,000 individuals to the final national census count erroneously. A much higher fabrication rate is more likely. A fabrication rate of 1% in the 1990 mini-census would have added 1,650,000 individuals to the national census count. Breiman 1994 at 467. A comparable or greater rate of error resulting from fabricated interviews is likely in the 2000 census.

2. Computer Errors

The census is a mammoth task that must be completed within a relatively short time. To do that, the Bureau relies on complicated computer programs. Errors in those programs are nonsampling errors. They can be difficult to identify. A computer processing error in 1990 overstated the undercount by almost 20% (as 2.1% instead of 1.7%). CAPE Report at 15. The error was discovered a year after the census, in the spring of 1991. *Id.* The Bureau uses statistical models to assist it in matching and cross-checking records. It uses statistical models to decide whether two records come from the same household. How many errors these programs are responsible for is uncertain. See Breiman 1994 at 469-470; Brown

¹⁵ This is one of the internal studies done by the Bureau to assess its PES mini-census in 1990. "P-sample" refers to the records of that mini-census.

1998 at 5 (providing additional references); Congressional testimony of Philip Stark, May 5, 1998.

In the 2000 census, the Bureau will not only mail out census forms (as it has in the past). It will provide "multiple opportunities, and multiple methods, to respond"—thereby "increas[ing] the possibility of multiple responses for a given person." J.A. 64. The Bureau is relying on "advances in computer technology" to avoid an "undue risk to the accuracy of the resulting census data." *Id.* As of December 1997, however, the Bureau had not developed or tested the software required to identify and eliminate duplicate responses. 1997 Inspector General's Report at 10. A single error, deeply embedded in thousands of lines of computer code—like that discovered by the CAPE Committee—can undo many if not all of the gains promised for the Bureau's plan.

3. Correlation Bias

Certain groups of people are likely to be missed by both the initial census enumeration and the mini-census. These include homeless people, illegal immigrants, and others who may try to evade the census. Individuals missed in both the traditional census and the mini-census constitute "correlation bias." See CAPE Report at 7, 15 n.2, 22-23; Morris L. Eaton, et al., "Planning for the Census in the Year 2000: An Update," Technical Report No. 484, Dep't of Statistics, U.C. Berkeley, at 2 (June 19, 1997). Correlation bias is a measure of how far out of calibration the adjusted returns are because both the census and the mini-census are missing the same people for some systematic reason, and not mere chance. The Bureau tries to take correlation bias into account, but this is hard to do when the size of the groups being systematically missed is unknown but large.

Correlation bias is especially problematic if it exists at different levels among the states. The 1990 census

indicates that this is the case. States with large minority populations in the Northeast would have lost population shares under the adjustment that the Bureau proposed.¹⁶ These Northeast states, however, are precisely the states that could be expected to gain in population shares because their large minority populations are traditionally thought to be disproportionately missed by the census. These counter-intuitive adjustments to state population shares proposed following the 1990 census indicate that correlation bias is a major source of inaccuracy in census adjustment based on a mini-census. Much of the population missed in the traditional census is also missed in the mini-census. See Brown 1998 at 6-9; David A. Freedman & Kenneth W. Wachter, *Planning for the Census in the Year 2000*, 20 EVALUATION REV. 355, 367 (1996) (hereinafter "Freedman & Wachter 1996").

From its 1990 mini-census, the Bureau calculated that 804,000 black males had been missed in the traditional census—534,000 less than the Bureau estimated from demographic analysis, indicating that the Bureau was underadjusting for males (presumably because even the mini-census was substantially undercounting them). By contrast, the Bureau calculated that 716,000 black females had been missed in the traditional census—218,000 more than the Bureau estimated from demographic analysis, indicating that the mini-census was substantially overadjusting for black females. Brown 1998 at 7 (summarizing Bureau data). Assuming that the undercounted black

¹⁶ If the 1990 census count had been adjusted, the ten states losing the largest share of the population because of adjustment would have been (in order): Pennsylvania, Ohio, Massachusetts, Michigan, Illinois, Indiana, Wisconsin, New York, New Jersey, and Connecticut. Brown 1998 at 6-8. It is hard to understand why adjustment should have cost those states population share while leaving effectively unchanged the population shares of Idaho, Delaware, Montana, Hawaii, Mississippi, Kentucky, Nevada, Wyoming, Arkansas, Oklahoma, Alaska, Utah, South Dakota, Vermont, Oregon, and North Dakota.

males were disproportionately living in the Northeast would explain the relatively large loss of population share Northeastern states would have suffered as the result of adjustment to the census count in 1990. *Id.*

4. *Incorrect Matching*

Matching records is "a very complex process" combining "elements of survey design, interviewing, matching, imputation, mathematical modeling and professional judgment." CAPE Report at 5. Illegible handwriting, incomplete information, use of aliases by immigrants and fugitives, and different spellings of foreign names can all make accurate record matching difficult. See Darga, "Gnats and Camels," at 9.

Mismatching records is a major source of error in correcting for an estimated undercount in the census. In 1992, for example, the Bureau's CAPE Committee directed "expert matchers" to review record matching for 104 blocks, constituting 2% of the 1990 PES mini-census. Those expert matchers identified enough matching errors for those 104 blocks to reduce the estimated national undercount from 1.7% to 1.6%. CAPE Report at 20. The identified matching errors from only 2% of the 1990 mini-census have erroneously increased the national population estimate by 248,718 people ($= .001 \times$ the unadjusted 1990 census count of 248,718,301). The extent of matching errors in the remaining 98% of the mini-census sample could not be estimated. *Id.* at 18-20. Even more matching errors can be expected in the 2000 census because it will limit searching to a single block.

C. Small Errors in the ICM Have a Large Impact on the Census Count

That matching errors in 2% of the census blocks in the 1990 mini-census erroneously increased the estimated 1990 undercount by almost 20% and increased the estimated population of the United States by almost 250,000

people indicates the exaggerated effect that small errors in the adjustment process can have. Kenneth Darga, in testimony to the House Subcommittee on the Census last May, provided another striking example of the exaggerated impact of sampling and nonsampling errors in the 1990 mini-census.

It is a basic demographic fact that the number of girl and boy children born is almost exactly equal (100/105). The Bureau's statistical sampling in 1990, however, produced wildly improbable and wildly varying estimates of the extent to which the traditional census had underreported male and female children aged 1-10 for 18 different demographic post-strata, as shown in the table attached as an appendix.¹⁷

Darga chose the 1-10 age group "because there is no obvious reason to expect householders to mis-report their young male children at a significantly different rate from their young female children." Darga, "Gnats and Camels," at 11. In each of these 18 post-strata, however, the estimated underreporting of boys and girls differed by more than ten percentage points. More surprising still, it showed

no discernible pattern. Sometimes the adjustment for boys is higher, but sometimes the adjustment for girls is higher; in one place black renters have a higher adjustment for boys, but in another place they have a higher adjustment for girls; in some places the gender discrepancy for whites is similar to the gender discrepancy for blacks, but in other places it is the opposite; sometimes one race category in a

¹⁷ These adjustment factors, corresponding to the percentage of undercount determined from the mini-census, are "raw." The Bureau in 1990 used various formulas to "smooth" them to "minimize the effect of sampling error." CAPE Report at 8. The assumptions on which the smoothing technique was based added its own errors, however. *Id.* The table illustrates the remarkable degree of obvious error even at the level of these post-strata.

large city has a higher adjustment for boys, but another race in the same city has a higher adjustment for girls. It is not surprising when signs of estimation error are visible for small components of the population in small geographic areas, but here we see apparently arbitrary adjustments for even the largest population groups in some of the largest cities and across entire regions. Thus, the significant adjustment factors in [the table] suggest a high level of measurement error rather than the high level of precision required for an adequate estimate of undercount.

Id. at 12-13.

Small, undetected errors resulting from sampling and nonsampling error in the mini-census result in much larger errors when they are used to "correct" the traditional census count.

III. APPROVAL OF THE CENSUS BUREAU'S PLAN IS ILLUSORY

The Bureau reported to Congress that its proposed use of statistical sampling was "the *only* solution" to the increasing inaccuracy and increasing cost of the census. J.A. 54 (original emphasis). The Bureau asserted that its use of statistical sampling was supported by "a scientific consensus" and "had been endorsed by three [National] Academy [of Sciences] panels and by numerous other organizations." J.A. 83. The Bureau specifically referred to endorsements by the American Statistical Association, the American Sociological Association, the General Accounting Office, and the Inspector General of the Department of Commerce. *Id.*

In fact, those "endorsements" are largely illusory. They ignore the details of the Bureau's plan and also ignore demonstrated problems with implementing it. After assessing "a massive amount of data" and "additional research," the Bureau's own high-level CAPE Committee

decided in 1992 that, even with refinements, the kind of statistical sampling that the Bureau plans for the 2000 census would not produce results as accurate as a traditional census below the state level. Even at the state level, the CAPE Committee did not think that the adjusted count would be more accurate for every state. CAPE Report at 1-2. The Committee feared that problems with the Bureau's plan "might never be solved" and that "a full adjustment based on such a system might never be possible." *Id.* at 32, 34.

What the American Statistical Association endorsed was the use of sampling generally, which it found "broadly applicable to census taking."¹⁸ However, the Statistical Association also said, in language the Bureau chose not to quote: "The specific design of a sample in a particular setting depends on the particular problem being addressed. In complex situations such as the census, the detailed sample designs require careful analysis by people skilled and experienced in census taking." *Id.* at 6. The Statistical Association did no such careful analysis. When the Statistical Association incorporated the general conclusions of its "Blue Ribbon Panel" into an amicus brief submitted below, it took "no position . . . on the details of any proposed use of statistical sampling in the 2000 census." *Id.* at 1.

Even the reports from the National Academy of Sciences are "generally theoretical rather than empirical, normative rather than descriptive." Freedman & Wachter 1996 at 371. For example, the 1994 Academy report acknowledged "controversy" and "lively debate" about problems with the Bureau's proposed use of statistical

¹⁸ Amicus Brief of the American Statistical Association, submitted below, at 7 (physically incorporating the report of "the ASA Blue Ribbon Panel," from which the *Report to Congress* quotes). The Foundation agrees with the Statistical Association that "it is not necessary to count every household and every person in the country in order to draw conclusions about the country." *Id.*

sampling to correct for undercounting in the census. PANEL TO EVALUATE ALTERNATIVE CENSUS METHODS, NATIONAL RESEARCH COUNCIL, COUNTING PEOPLE IN THE INFORMATION AGE 109, 120 (Duane L. Steffey & Norman M. Bradburn, eds., 1994). It nevertheless concluded that this use of sampling "*may well lead to substantially better estimates.*" *Id.* at 371 (emphasis added). It did not, however, address the evidence from the 1990 census that using such statistical sampling might well lead to worse estimates, especially at the local level.

The 1995 Academy report acknowledged that the census is "the only practical source" for the detailed data required "at the smallest possible geographic level, namely the census block" in order to support apportionment and to "permit legislative districts to be drawn by combining blocks to meet court-mandated criteria for equal populations across districts and appropriate representation of minority groups under the Voting Rights Act." PANEL ON CENSUS REQUIREMENTS IN THE YEAR 2000 AND BEYOND, NATIONAL RESEARCH COUNCIL, MODERNIZING THE U.S. CENSUS 22 (Barry Edmonston & Charles Schultze, eds., 1995).¹⁹ The report acknowledged that using statistical sampling to correct for undercount would involve increasingly "coarse" adjustments "as geographic detail becomes smaller" and that accordingly there was "fervent debate among demographers and statisticians about the best methods to be used for completing the census count for small geographic areas." *Id.* at 100. It concluded: "further work on the census methods to be used for small-area estimates is needed before a decision should be made." *Id.* This is hardly a ringing endorsement.

As "further work" was done, the Academy appears to have abandoned the position that the census was the only

¹⁹ Appendix E to this report, "State and Local Needs for Census Data," sets out in detail why "[s]mall-area census data are essential to state and local government agencies." *Id.* at 273-89 (quotation from 274).

practical source for the detailed information required for apportionment and redistricting set out so clearly in the 1995 report. Its 1997 report acknowledged that at the block and block-cluster level, using statistical sampling can *decrease* the accuracy of the census by introducing more errors than it removes. PANEL TO EVALUATE ALTERNATIVE CENSUS METHODOLOGIES, NATIONAL RESEARCH COUNCIL, PREPARING FOR THE 2000 CENSUS 11 (Andrew A. White & Keith F. Rust, eds., 1997). The Academy, however, asserted that increasing error at the block level did not matter because those errors would cancel each other out for larger geographical areas. It said:

The important point to note here is that for the counts for census blocks, the level of sampling error is, relatively speaking, not an appropriate criterion for judging the quality of the census. Although block counts may contribute to the congressional redistricting process, for example, it is important to keep in mind that the results in a redistricting process are the counts of the congressional districts that are eventually created

Id. at 12. The Academy this time was simply wrong. The accuracy of census counts at the block level is an essential criterion for judging the quality of the census, as the Academy recognized in its 1995 report. It is no endorsement of statistical sampling to say that redistricting based on erroneous census information resulting from statistical sampling does not matter because the errors that led to new districts with new boundary lines will eventually be offset by other sampling errors from within the new district. The boundaries that determine a congressional district depend on data from census blocks. Moreover, even at the district and state levels, the more important nonsampling errors do not tend to cancel each other out, as sampling errors do. The 1997 report also ignores the needs of state and local governments enumerated in the 1995 report.

An assessment by the Inspector General of the Commerce Department in December 1997—after the *Report to Congress* but describing issues that had long been debated—pointed to two among several areas related to the use of sampling to correct for undercounting where “significant research questions have not yet been answered”: *First*, the results of the post-census survey introduced “increasingly error-prone estimates for small localities and in particular for block-level data”; and *second*

the assumption that members of demographic subgroups share a probability of being missed in the census, called the homogeneity assumption, limits the accuracy of the estimates. The ICM survey estimates a person’s chances of being undercounted based on only a few characteristics. In reality a person may be missed for many diverse reasons. Therefore, the survey offers only an approximation of who is undercounted. The bureau examined several techniques for addressing this problem. Only one showed promise, and it has serious unresolved mathematical questions. Therefore, the bureau will be forced to address this important issue with a tool that may not be fully evaluated and tested before implementation.

1997 Inspector General’s Report at 14.

The fact is that the Bureau proposes to apply statistical sampling in an unprecedented way that produced bizarre results in 1990 and can be expected to do so again in the 2000 census.

CONCLUSION

The Bureau’s plan is an untested experiment that is unlikely to produce accurate results at the local or national level. The Bureau’s own CAPE Committee recognized in 1992 that problems with the Bureau’s plan “might never be solved” and that “a full adjustment based on such a system might never be possible.” CAPE Report at 32, 34. There is good reason to believe that those problems

have still not been solved. As the Inspector General of the Commerce Department concluded at the end of 1997, the Bureau's statistical sampling plan raises "significant research questions" that "have not yet been answered." 1997 Inspector General's Report at 14.

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APPENDIX

Region	Area Type	Tenure	Race	Adjustments	
				Male	Female
Pacific	Non-Central Cities	Renter/ Owner	Asian/Pacific	+ 5%	+ 17%
Mid Atlantic	Central Cities in New York City PMSA	Renter/ Owner	Asian/Pacific	+ 25%	+ 9%
East North Central	Central Cities in Metro Areas w/Central City > 250K	Owner	Black	+ 26%	+ 15%
Pacific	Central Cities in Los Angeles PMSA	Owner	Black	+ 28%	+ 8%
Mid Atlantic	Central Cities in New York City PMSA	Owner	Black	+ 0%	+ 23%
South Atlantic	Central Cities in Metro Areas w/Central City > 250K	Renter	Black	+ 26%	+ 16%
Pacific	Central Cities in Los Angeles PMSA	Renter	Black	+ 20%	+ 10%
Pacific	Non-Central Cities	Renter/ Owner	Black	+ 31%	+ 6%
Mid Atlantic	Central Cities in Metro Areas w/Central City > 250K	Renter/ Owner	Hispanic (except black)	+ 2%	+ 16%
Mid Atlantic	All Central Cities	Renter/ Owner	Hispanic (except black)	+ 14%	+ 2%
West South Central	Central Cities in Houston, Dallas, & Forth Worth PMSA	Renter/ Owner	Hispanic (except black)	+ 8%	+ 19%
South Atlantic	All Non-Metro Areas & All Non-Central Cities	Renter/ Owner	Hispanic (except black)	+ 9%	+ 22%
West South Central	Central Cities in Houston, Dallas, & Forth Worth PMSA	Renter	White, Native Am. & Asian/Pacific except Hisp.	- 5%	+ 11%
East North Central	Central Cities in Metro Areas w/Central City > 250K	Renter	White, Native Am. & Asian/Pacific except Hisp.	+ 21%	+ 4%
East North Central	Central Cities in Metro Areas w/Central City > 250K	Renter	White, Native Am. & Asian/Pacific except Hisp.	- 4%	+ 14%
West South Central	Central Cities in Houston, Dallas, & Forth Worth PMSA	Renter	White, Native Am. & Asian/Pacific except Hisp.	+ 7%	+ 21%
South Atlantic	Central Cities in Metro Areas w/Central City > 250K	Renter/ Owner	White, Native Am. & Asian/Pacific except Hisp.	+ 10%	- 1%
South Atlantic	Non-Metro Areas Except Places > 10K	Renter/ Owner	White, Native Am. & Asian/Pacific except Hisp.	+ 3%	+ 16%